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American Ceramic Society honors Dane Spearing

Dane R. Spearing, deputy group leader of the Nuclear Materials Science Group (MST-16), has won a place among the American Ceramic Society's (ACerS) 2011 Class of Fellows.

The society's Panel of Fellows identified the new class of 20 Fellows, which includes members from around the globe, based on outstanding contributions in scholarship, industry, or service to the society.

Spearing's research has focused on long-term storage of plutonium compounds in ceramic and nonceramic packages, resulting in a revised Department of Energy storage standard. Spearing is a member of the ACerS Nuclear and Environmental Technology Division serving as division chair in 2005–2006. He edited five *Ceramic Transactions* volumes and has served on the Society's Legislative and Public Affairs Committee, the Member Services Committee, and Internet Task Force.



Spearing joined Los Alamos National Laboratory in 1997 after graduating from Stanford University with a PhD in geology and a minor in materials science. He was a team leader for eight years in Nuclear Materials Technology and Plutonium Manufacturing & Technology divisions. In 2010, he became deputy group leader for MST-16.

The American Ceramic Society, which has recognized outstanding scientists since 1898, held this year's awards banquet in October in Columbus, Ohio.

Technical contact: D. Spearing

Understanding the complex phase diagram of uranium

Research featured on PRL cover

In research featured on the cover of September's *Physical Review Letters*, three Los Alamos National Laboratory scientists and their French and German collaborators present a deeper understanding of the complex phase diagram of uranium and the interplay between the charge density wave (CDW) and superconductivity. The joint experimental and theoretical investigation lays the foundation for further extension of theory into strongly correlated systems.



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WSST, VPP, ISM, BBS, HPI, HRO, IWDs...What does all this mean? As we approach the holiday season, I wanted to take a moment to reflect on the "meaning" of safety. With the multitude of safety programs, initiatives, and procedures here at work, it can seem impossible to do our jobs, no less see the benefit of all this.

Safety is about people and about taking care of each other and ourselves. I cannot think of a more appropriate time of year to emphasize the need to focus on this topic. A workplace safety program is meant to ensure we can have a rewarding, fulfilling career that does not come at the sacrifice of our well being. An injury, whether at work or home, can instantaneous change many of the things we can take for granted, such as our vision, hearing, and mobility. Injury statistics are numbers that are easily translated to "it will not happen to me," but we need to remember that numbers represent people. If we think about ones we know, I believe most can think of someone affected by an injury.

Let me tell you about my injury that happened a few years ago. While playing fast-pitch softball, I collided with a runner coming down the first base line. The result was a shattered left wrist that has left me with a plate and screws in my arm and significantly reduced range of motion. While not a major deal, it's the little things that I notice, like holding a plate or pain when shoveling snow or golfing.

So what to do? First, make sure you and others are safe during this time of year by driving safely, planning ahead, and thinking about yourself and those around you, especially on the roadways. When you return from break think about how you



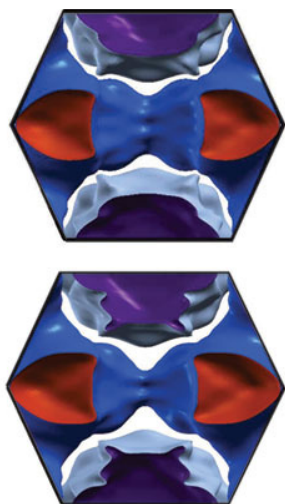
"Safety is about people and about taking care of each other and ourselves."

can get involved to make things better for you and your co-workers. The Worker Safety and Security Teams (WSSTs) are worker-led teams that are trying to make improvements to help each of us; so consider volunteering or participating on a team or ask a WSST member to visit your work area to help with needed solutions. The OSHA Voluntary Protection Program (VPP) and the DOE Integrated Safety Management (ISM) are high-level safety programs based on management commitment and employee involvement. Talking with your co-workers and managers regarding safety concerns or solutions is an important part of being involved to create a learning organization. We often get so focused at the task at hand that vital communication is negated, so be involved and vocal during work planning, execution, and feedback. Behavioral-Based Safety (BBS) is a peer-to-peer observation and communication process that looks at safe and unsafe behaviors and conditions. In my opinion, the power of BBS is establishing an organization that fosters open communication and learning. Human Performance Improvement (HPI) and High Reliability Organization (HRO) are based on the premise that people are fallible and we will make mistakes. The goal is to develop systems that are robust enough to minimize the impact of our errors. I challenge each of you to start the new year by engaging in a people-based approach to safety by looking for opportunities to improve work conditions, discuss issues with managers and co-workers, and taking care of each other.

Enjoy this wonderful holiday season and the break from work. Take care of yourself and others. Safe and happy holidays!

MST-DO Operations Advisor Jim Coy

Uranium... At ambient pressure, uranium is the only element to exhibit a phase transition to a CDW state below $T_0 = 43$ K. This transition has been ascribed to nesting of certain features of the Fermi surface. The ambient pressure superconductivity of uranium, reported in the early studies below 1 K, is still controversial, but scientists agree that the superconducting temperature T_c exhibits a maximum of about 2 K at around 1.5 GPa, when the CDW disappears.



Cross section of the Fermi-surface topology for the α -U structure calculated at ambient pressure (top) and 20 GPa (bottom). The different colors correspond to different sheets of the Fermi surface.

The room temperature crystal structure of uranium is unique for an element at ambient pressure. In this study, the scientists performed inelastic x-ray scattering experiments on a single crystal sample at the European Synchrotron Radiation Facility (ESRF) in France, and they performed theoretical calculations using density functional theory. Los Alamos researchers prepared and provided the high-quality, fully characterized single crystal sample, work which could not have been done elsewhere.

The new measurements and calculation demonstrate the strong pressure (and momentum) dependence of the electron-phonon coupling, whereas the Fermi-surface nesting is surprisingly independent of pressure.

The Los Alamos portion of the work was funded by the Department and Energy and carried out by Jason Lashley and Roland Schulze (both Materials Technology-Metallurgy, MST-6), and Robert Albers (Physics of Condensed Matter & Complex Systems, T-4). The research supports the core missions of the Laboratory in furthering the understanding of the fundamental behavior and nature of actinide materials.

Reference: "Understanding the Complex Phase Diagram of Uranium: The Role of Electron-Phonon Coupling," by S. Raymond and J. Bouchet (the Alternative Energies and Atomic Energy Commission, France), G. H. Lander (Institute for Transuranium Elements, Germany), M. Le Tacon (ESRF and Max-Planck-Institute for Solid State Research, Germany), G. Garbarino and M. Hoesch (ESRF), J.-P. Rueff (Synchrotron SOLEIL, and Université Pierre et Marie Curie, France), M. Krisch (ESRF), J. C. Lashley and R. K. Schulze (MST-6), and R. C. Albers (T-4), *Phys. Rev. Lett.* **107**, 136401 (2011).

Technical contact: Jason Lashley

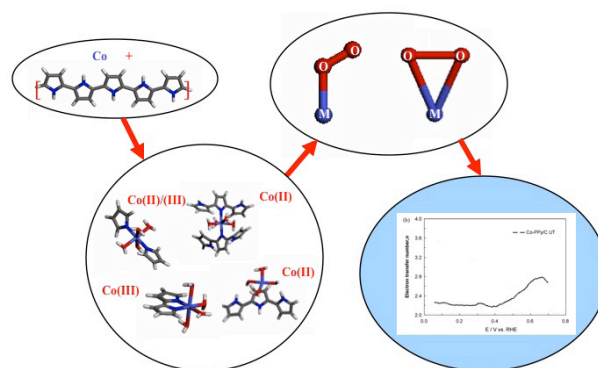
Fuel cell technology and the puzzle of nonprecious group metal catalysts

In a paper published in the *Journal of Physical Chemistry C*, researchers from Los Alamos National Laboratory and the National Research Council Canada Institute for Fuel Cell Innovation explored cobalt-polypyrrole (Co-PPy) composites as a possible alternative to the use of expensive platinum as a catalyst in polymer electrolyte membrane fuel cells (PEMFC).

Their insights are expected to help guide future efforts to design non-precious metal catalysts in PEMCSs, which could serve as efficient, economical sources of energy.

In the past decade, significant progress has been achieved in the catalytic activity and durability of nonprecious group metal catalysts derived from transition metals, nitrogen and carbon. However, the active site structure of the nonprecious group metal catalyst is a puzzle that inhibits innovative synthetic route design and impedes breakthroughs.

In an effort to understand the origin of the catalytic activity of highly complex Co-PPy composites, the researchers employed density functional theory, spectroscopic techniques (Electron Paramagnetic Resonance, Fourier Transformed Infrared spectroscopy, Extended X-Ray Absorption Fine Structure), and electrochemical data to investigate the structure and energy of possible catalytic sites and the corresponding reaction pathways for the oxygen reduction reaction. After examining four different structures of the active site, the researchers concluded that the catalytic activity is significantly different for the various sites and depends strongly on the electrode potential.



Understanding catalytic activity of cobalt polypyrrole composites: From catalyst synthesis to theoretical analysis of possible active sites and their interactions with oxygen, to theory verification by experimental data.

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Catalysts... The Los Alamos portion of the work was supported by DOE Energy Efficiency and Renewable Energy Office's Fuel Cell Technologies Program and the Los Alamos Laboratory-Directed Research and Development program. The DOE Office of Basic Energy Sciences Division of Materials Sciences and Engineering also provided funding for Michael Blair (Polymers & Coatings, MST-7).

Reference: "Theoretical Study of Possible Active Site Structures in Cobalt-Polypyrrole Catalysts for Oxygen Reduction Reaction," *J. Phys. Chem. C*, **115** (33) (2011), by Zheng Shi, Hansan Liu, Kunchan Lee, Eben Dy, Jiujun Zhang and Zhong-Sheng Liu (all NRC Institute for Fuel Cell Innovation, Canada), Michael Blair (Polymers & Coatings, MST-7), and Jerzy Chlistunoff and Piotr Zelenay (both Sensors & Electrochemical Devices, MPA-11).

Technical contact: Piotr Zelenay

Proton radiography for process-aware solidification studies

Materials Technology-Metallurgy (MST-6) and the Proton Radiography Team completed the first in situ examinations of melting and solidification in Al-In, Ga-Bi, Sn-Bi, and Al-Cu alloys at the Laboratory's 800-MeV Proton Radiography (pRad) Facility.

A furnace apparatus was built by MST-6 and inserted into pRad for these experiments, and metal alloy sections ranging from 1-6 mm

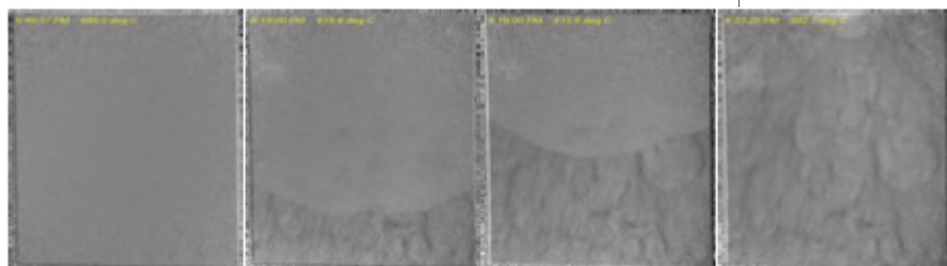
in thickness were imaged during melting and solidification. Example time-resolved images captured during solidification of a 6-mm-thick Al-In sample are shown in the figure for a 44 x 44 mm² field of view.

The results obtained from this work demonstrate the usefulness of pRad for in situ monitoring of solidification phenomena and microstructure evolution.

These results also highlight future opportunities for performing process-aware solidification studies at Los Alamos that will advance solidification science and casting technology. This Materials in Extremes/MaRIE related project was supported by LDRD Reserve Investments.

Amy Clarke (principal investigator), Jason Cooley, Tim Tucker, Robert Field, Robert Aikin, David Korzekwa, Duncan Hammon, Kester Clarke, Steve Quintana, Jim Foley, Ralph Trujillo, Patrick Kennedy, Bo Folks, Tim Beard, Randy Edwards, Mark Paffett, JD Montalvo, Dane Knowlton, and Paul Dunn (all MST-6); Thomas Ott, Joshua Hill, Martha Barker, Finian O'Neill, and Megan Emigh (MST-6 summer students); Frank Merrill, Brian Hollander, Chris Morris, Fesseha Mariam, Carter Munson, and the Proton Radiography Team (Neutron Science and Technology, P-23; Subatomic Physics, P-25); Marshall Maez (Prototype Fabrication-Fabrication Services, PF-FS); Brian Patterson (Polymers and Coatings, MST-7); David Teter (Materials Science and Technology, MST-DO), and Dan Thoma (Institutes, INST-OFF) contributed to this work.

Technical contact: Amy Clarke



Example images obtained during solidification from the bottom upward of a 6 mm thick Al-In sample using pRad. The field of view is approximately 44 x 44 mm².

Celebrating service

Congratulations to the following MST Division employees celebrating service anniversaries this month:

Dane Spearing, MST-16	15 years
Joseph Reynolds, MST-16	10 years
Fritzgerald Sandoval, MST-16	10 years
Tiberiu Stan, MST-8	5 years

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EPS Communications, at 606-1822, or kkippen@lanl.gov.

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To read past issues, please see www.lanl.gov/orgs/mst/mst_e-news.shtml.



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Random vehicle inspections underway

Effective December 1, random vehicle inspections began at the East and West Jemez Road Vehicle Access Portals (VAPs). Everyone entering the Laboratory through the East and West Jemez VAPs must cooperate with SOC Los Alamos protective force personnel if called upon for a vehicle search.

Drivers notified of an inspection should move to the search area indicated. An inspection team, including canine, will inspect the entire vehicle, including items being towed. Upon completion, drivers will either be given permission to proceed or asked to remain as necessary. Workers who refuse a search will be requested to turn around. Note: Searches will continue at the Truck Inspection Station on the truck route (East Jemez Road).

See the list of articles prohibited on Laboratory property that are subject to confiscation (int.lanl.gov/security/physical/controlled_prohibited.shtml). Questions? Write to psalazar@lanl.gov.

Holiday reminders

The holidays add distractions to workers' routines. The Safety Smart at int.lanl.gov/security/documents/security-smart/2011/holidays1211.pdf provides a few reminders to help ensure security at the Laboratory before the holidays.

Driving a government vehicle?

Did you know that LANL workers cannot use cell phones and similar electronic devices or perform other distracting activities while operating government vehicles? Lab policy on Vehicle and Pedestrian Safety, P101-7, states that these activities should only be performed when the vehicle is safely stopped or parked. (Note: This requirement does not apply to Emergency Operations and Security subcontractor personnel responding to an emergency.)

Workers should also avoid distractions while operating privately-owned vehicles on LANL-managed roadways. Such distractions include, but are not limited to,

- wearing headphones or other listening devices that could prevent the recognition of emergency alarms;
- using cellular phones and similar electronic devices;
- reading maps; and
- operating a global positioning device.

Safely stop or park your vehicle before performing these activities.

Meeting planning services available

Got a conference that needs organizing, an event to be planned?

Rose Romero, the ADEPS meeting coordinator, can help.

With 15 years of Los Alamos conference planning experience, Romero has assisted staff members in planning conferences both large and small, from locally held meetings with a dozen participants to international conferences for hundreds of attendees. Knowledgeable in the Laboratory's conference management policies and associated allowable conference costs, she can help in overseeing the details that ensure a smooth, successful event.



Romero can assist with developing and overseeing allocated workshop budgets, obtaining the necessary cost codes for workshop funding, negotiating and overseeing contracted food services, and in planning and executing workshop and conference web sites. Her experience includes arranging for transportation, conference facilities, and accommodation and preparing pre-conference materials such as invitation letters, badges, folders, and participant lists. During the workshop, she can manage the registration desk, help with setting up meeting rooms, and with compiling agendas, abstracts, and related materials into post-conference documents.

"I love the variety and working on things from start to finish," Romero said. "Meeting planning is like putting together a puzzle. Every piece must fit the puzzle for the puzzle to be successfully complete."

Romero can be reached by calling 665-7657 or emailing rbromero@lanl.gov.

“Meeting planning is like putting together a puzzle. Every piece must fit the puzzle for the puzzle to be successfully complete.”
